

# CE-306: Construction Management



LECTURE 1

# CE-306: CONSTRUCTION MANAGEMENT

## Teachers/Instructors:

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## Class Rules:

1. Attendance: You are expected in each class, Attendance less than 75% will attribute to the WF grade.
2. Participation: Class participation and discussion will be encouraged and have 5% marks.
3. Cell phone: Preferably don't bring in the class.  
However, the use of mobile phone during lecture are strictly not allowed.
4. You are expected to produce your own work
5. Assignments should be submitted in proper folder.

# CE-306: CONSTRUCTION MANAGEMENT

## COURSE OUTLINE

- History of construction management.
- The nature and characteristics of the construction industry.
- General principles of construction management.
- Construction project life cycle.
- Organization structures.
- Construction contracts & their procurement.
- **Project Planning and Budgeting.** Project monitoring and control.
- Introduction to **construction productivity analysis**; definition, factors affecting construction productivity analysis (On-site and Off-site).
- **Application of Engineering Economics Concepts:** Interest and present worth calculations, comparison of alternatives, replacement, depreciation and depletion; tax, effect of inflation. Application of engineering economics in construction equipment management.
- Use of software in construction management and planning.
- Application of ISO 9000 to construction management and planning.
- Total quality management.

## **RECOMMENDED BOOKS:**

1. Project Management: A System Approach to Planning, Scheduling, and Controlling by Kerzner, Harold. John Wiley & Sons, Inc.
2. Management of Construction Projects by Brian Cooke John Wiley & Sons, Inc.
3. A Guide to the Project Management Body of Knowledge (PMBOK). Project Management Institute (PMI) , USA.
4. Engineering Economy by Leland Blank Anthony Tarquin, 7th edition.
5. Fundamental of Engineering Economics by Chan S Park 3rd Edition.

# What is a Project?



# What is a Project?

A project is a temporary endeavor consisting of a sequence of connected activities undertaken by limited resources to create a unique product or service that must be completed within specified time, within budget, and according to specification.

## Temporary Endeavor

Endeavor means an attempt to achieve a goal

Temporary means that every project has a definite beginning and a definite end. The end is reached when the project's objectives have been achieved, or when it becomes clear that the project objectives will not or cannot be met and the project is terminated.

Temporary does not necessarily mean short in duration (many projects last for years), nor it applies to the product or service created (many projects are undertaken to create lasting results – for example, a project to erect a national monument will create a result expected to last for centuries).

# What is a Project?

## Sequence of Connected Activities

A project comprises of a number of activities that must be completed in some specified order, or sequence. **An activity is a defined chunk of work.** The sequence of the activities is based on technical requirements. Activities within a project are interconnected. To determine the connectedness, it is helpful to think in terms of inputs and outputs. The output of one activity or set of activities becomes the input to another activity or set of activities.

## Undertaken by limited resources

Projects have resource limits, such as **a limited amount of people, materials or equipment and budget** that are dedicated to the project.

## Unique Product or Service

Unique means that the **product or service is different in some distinguishing way from all similar products or services.** A product or service may be unique even if the category it belongs to is large. For example, many thousands of office buildings have been developed but each individual facility is unique – different location, different owner, different design, different contractor, and so on.

# What is a Project?

## Within Specified Time

Projects have a **specified completion date**. This date can be self-imposed by management or externally specified by a client or government agency.

## Within Budget

Projects have **cash inflow constraints**. The source of finance may be public funds, bank loans or private investments.

## According to Specification

The client expects a certain level of **functionality and quality from the project**. These expectations can be self-imposed, such as the specification of the project completion date, or client-specified, such as use of wall paper for wall finishing in a bungalow, or law imposed, such as environmental considerations.

**Hence the term 'construction project' refers to a high-value, time bound, special construction mission with predetermined performance objectives.**



# Basic Features of a Project

- Following are the basic features of a project;
  - It should have **an objective** and it necessitates investment of resources for the determined objective.
  - There are **constraints with respect to time and cost of the project.**
  - Projects are “temporary organizations” with a **beginning and an end.**
  - Every project proceeds through a **cycle of activities.** There is a list of activities for a project showing the **dates for starting and finishing them, which is called a “schedule”.**
  - A number of parties may come together to form a **“project coalition”** to ensure the required resource base for the project.
  - It requires a **“project team”** to be set up probably of a multi-disciplinary nature and headed by a **project manager.**
  - Inputs of the project are **financial resources** in order to cover the costs of investment, and **human resources** which transform ideas into reality.
  - Each **project is unique.** Although exactly the same project is to be carried out, as the location, external factors (climate etc.), parties involved, time and budget constraints etc. are different, projects have their unique features which make them unique undertakings.

# Types of Projects

## Type of Project

Administrative

Construction

Computer Software Development

Design of Plans

Equipment or System Installation

Event or Relocation

Maintenance of Process Industries

New Product Development

Research

## Product of Project (Examples)

-installing a new accounting system

-a building or a road

-a new computer program

-architectural or engineering plans

-a telephone system or a IT system

-move into a new building

-petro-chemical plant or electric  
generating station

-a new drug or aerospace/defense  
product

-a feasibility study or investigating a  
chemical

# Comparison of Projects with operations

## PROJECTS

- Projects are temporary and unique.
- The purpose of a project is to attain its objective and then terminate.
- The project concludes when its specified objectives have been achieved.

## OPERATIONS

- Operations are ongoing and repetitive.
- The purpose of an ongoing operation is to sustain the business.
- Operations adopt new set of objectives and the work continues.

# Project Vs. Operation

- Operations are organizational functions performing an ***ongoing*** execution of activities.
- Examples: Production, manufacturing, and accounting operations.
- Projects require project management while operations require Business Process Management (BPM) or operations management.

# Project or Operation ?



# Project or Operation ?



# Project or Operation ?



# Comparison of operations with Projects

- **Operations, Repetitive Work**

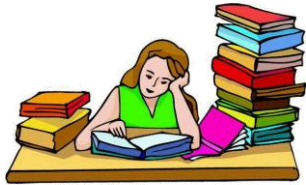
- taking class notes
- daily entering sales
- Responding to customers requests
- Meeting with an employee
- Attending a conference

- **Projects**

- writing a term paper
- Construction of building or a road
- Setting up a telephone system or a IT system
- Development of a new computer program
- Writing and publishing a book
- Hiring a sales man
- Arrange for a conference
- Opening for a new shop



# Examples of „Simple Projects“



Research Papers



Relocating



Tree Planting Campaigns



Weddings



Relief Collections



Painting



Preparing for Examinations



Parties

# Examples of „Complex Projects“



Bridges



Nuclear Power Stations



Olympic Games



Dams

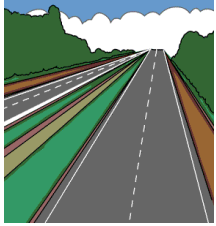


Man on the Moon



Skyscrapers

# Examples of „Complex Projects“



Highways



Large Factories



Airports



Power Grids



Transnational  
Oil & Gas Pipelines



Software  
Development

# Project Resources

The project manager must control company resources within time, cost, and performance. Most companies have four resources:

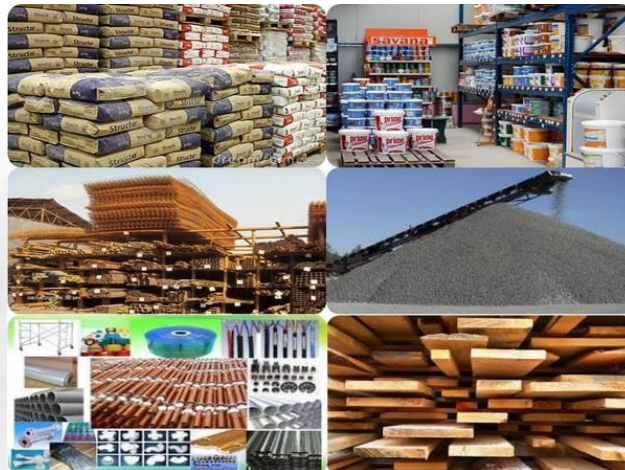
4 M's

**Manpower** – Human Resource Management

**Material** – Procurement Management

**Machinery** – Equipment and Plant Management

**Money** – Financial Management



# What is Project Management?



Project management is the discipline of planning, organizing, motivating, and controlling resources to achieve specific goals.

“Project Management is the skills, tools and management processes required to undertake a project successfully”.

- Project Management comprises:
  - A **set of skills**. Specialist knowledge, skills and experience are required to reduce the level of risk within a project and thereby enhance its likelihood of success.
  - A **suite of tools**. Various types of tools are used by project managers to improve their chances of success. Examples include document templates, registers, planning software, modeling software, audit checklists and review forms.
  - A **series of processes**. Various management techniques and processes are required to monitor and control time, cost, quality and scope on projects. Examples include time management, cost management, quality management, change management, risk management and issue management.

# THE FIVE PRINCIPAL FUNCTIONS OF MANAGEMENT

## PLANNING

Identify goals and determine the best course of action required to achieve those goal.

## ORGANIZING

Assign responsibilities to the employees with detailed skill sets needed to complete the task.

## STAFFING

Hire the right people, for the right positions to the help the organization achieve its objectives

## COORDINATING

Coordination involves supervision, communication and direction by the management.

## CONTROLLING

Monitor employees' performance, compare it with the goals, and take corrective action as needed.



# Five Principal Functions of Management

The following are the functions of management:

## 1. Planning

- Planning is determination of **courses of action** to achieve **desired goals**.
- The PMI defined the planning process in the PMBOK (4<sup>th</sup> edition, 2008) as **“Those processes performed to establish the total scope of the effort, define and refine the objectives, and develop the course of action required to attain those objectives”**.
- Project planning serves as a foundation for several related functions, such as cost estimating, scheduling, project control, quality control, safety management etc.
- **Planning is the selection of objective, programs and procedures.**
  - Deciding:- What is to be done
  - When it is to be done
  - How it is to be done
  - Who is to do it

Having objectives in mind; planning helps managers ‘do the right things’.

# Five Principal Functions of Management

## 1- Planning

This involves the creation of a:

1. **Project Plan** (outlining the activities, tasks, dependencies and timeframes)
2. **Resource Plan** (listing the labor, equipment and materials required)
3. **Financial Plan** (identifying the labor, equipment and materials costs)
4. **Quality Plan** (providing quality targets, assurance and control measures)
5. **Risk Plan** (highlighting potential risks and actions taken to mitigate them)
6. **Acceptance Plan** (listing the criteria to be met to gain customer acceptance)
7. **Communications Plan** (listing the information needed to inform stakeholders)
8. **Procurement Plan** (identifying products to be sourced from external suppliers).

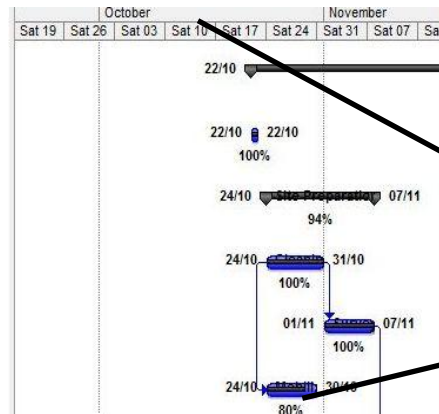


# Five Principal Functions of Management

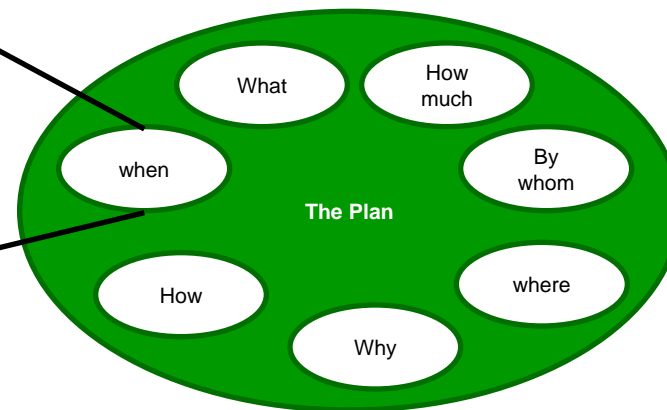
## Planning and Scheduling

Planning is the process of determining how a project will be undertaken. It answers the questions:

1. “What” is going to be done,
2. “how”,
3. “where”,
4. By “whom”, and
5. “when” (in general terms: start and finish).



Scheduling is just one part of the planning effort.



Scheduling deals with “when” on a detailed level .

# Five Principal Functions of Management

## 2. Organizing

- It is the process of bringing together physical, financial and human resources and developing productive relationship amongst them for achievement of organizational goals.
- According to Henry Fayol, “To organize a business is to provide it with everything useful or its functioning i.e. raw material, tools, capital and personnel’s”.
- To organize a business involves determining and providing human and non-human resources to the organizational structure.

Organizing as a process involves:

- Identification of activities.
- Classification of grouping of activities.
- Assignment of duties.
- Delegation of authority and creation of responsibility.
- Coordinating authority and responsibility relationships.

# Five Principal Functions of Management

## 3. Staffing

- It is the function of manning the organization structure and keeping it manned.
- Staffing has assumed greater importance in the recent years due to advancement of technology, increase in size of business, complexity of human behavior etc.
- The main purpose of staffing is to put right man on right job i.e. square pegs in square holes and round pegs in round holes.
- Staffing involves:
  - Manpower Planning (estimating man power required for the project, choose the persons and giving them the right place).
  - Recruitment, selection & placement.
  - Training & development.
  - Remuneration.
  - Performance appraisal.
  - Promotions & transfer.



# Five Principal Functions of Management

## 4. Directing/Coordinating

- It is considered life spark of the enterprise which sets it in motion the action of people because planning, organizing and staffing are the mere preparations for doing the work.
- Direction is that inert-personnel aspect of management which deals directly with influencing, guiding, supervising, motivating sub-ordinate for the achievement of organizational goals.

Direction has following elements:

- **Communications-** is the process of passing information, experience, opinion etc. from one person to another. It is a bridge of understanding.
- **Supervision-** implies overseeing the work of subordinates by their superiors. It is the act of watching & directing work & workers.
- **Motivation-** means inspiring, stimulating or encouraging the sub-ordinates with zeal to work. Positive, negative, monetary, non-monetary incentives may be used for this purpose.
- **Leadership-** may be defined as a process by which manager guides and influences the work of subordinates in desired direction.

# Five Principal Functions of Management

## 4. Directing/Coordinating

### Managerial Leadership Styles

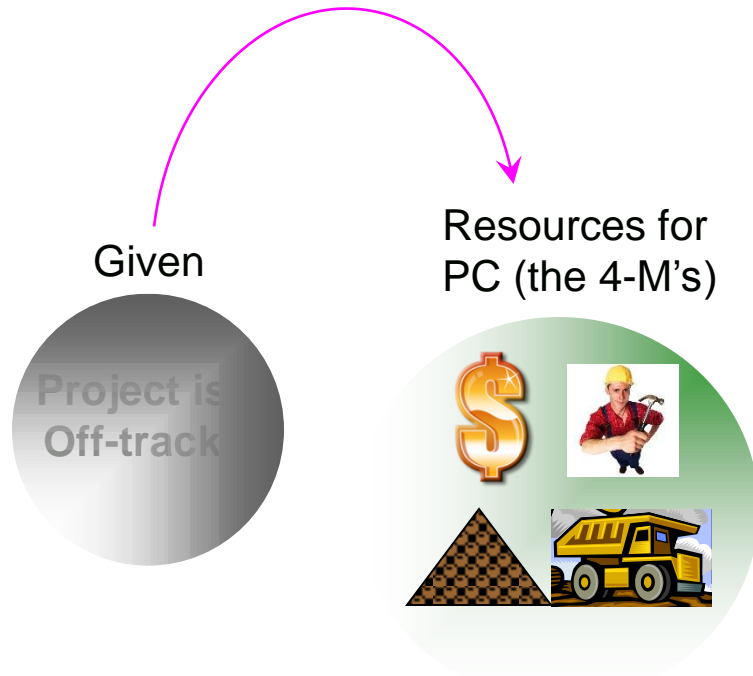


# Five Principal Functions of Management

## 5. Controlling

- *It implies measurement of accomplishment against the standards and correction of deviation if any to ensure achievement of organizational goals.*
- The purpose of controlling is to ensure that everything occurs in conformities with the standards.
- An efficient system of control helps to predict deviations before they actually occur. Therefore controlling has following steps:
  - Establishment of standard performance.
  - Measurement of actual performance.
  - Comparison of actual performance with the standards and finding out deviation if any.
  - Corrective action.

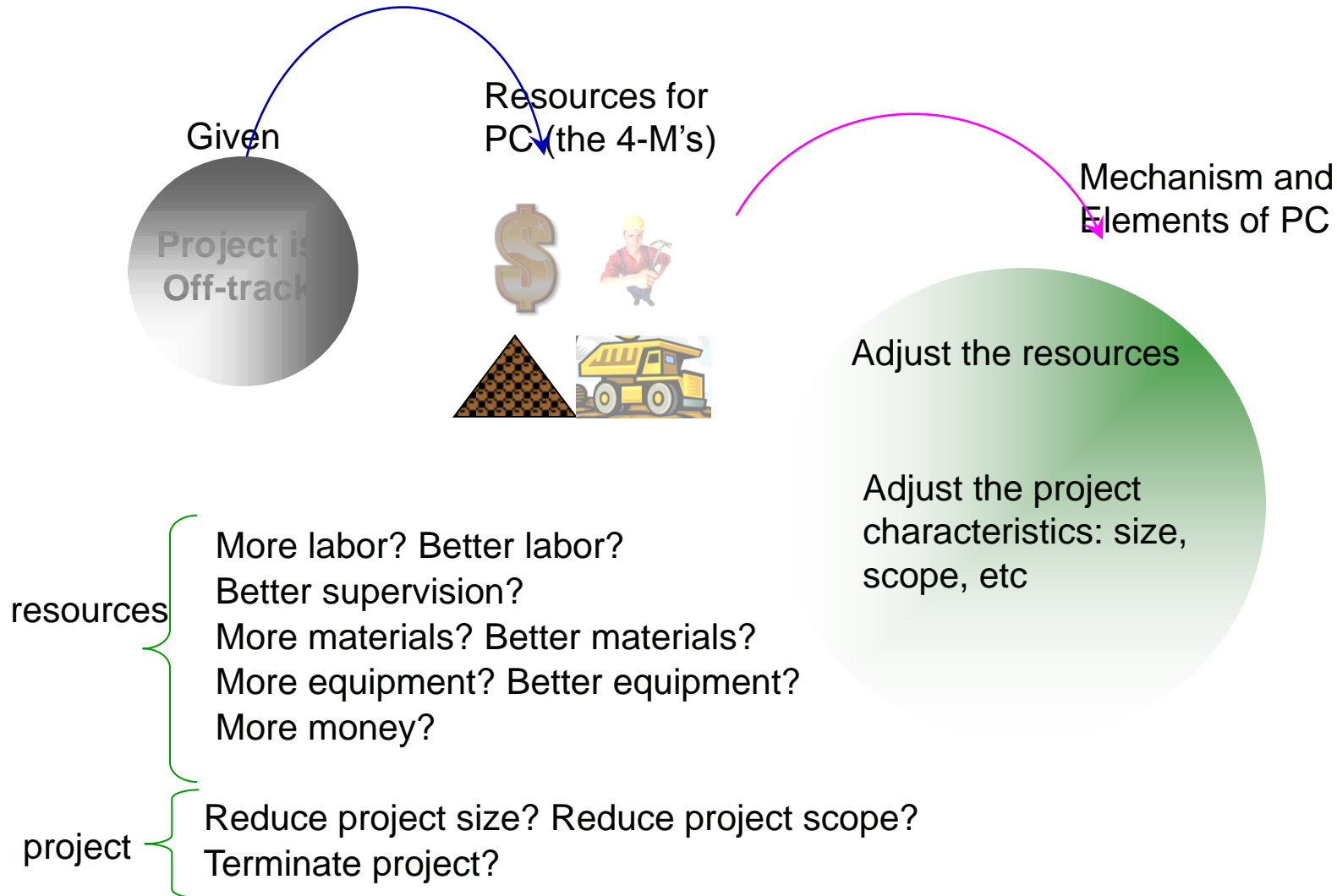
# 5-Project Controlling



Resources available to the Project Manager for Project Control:

- Money
- Manpower (labor)
- Materials
- Machinery (Equipment)

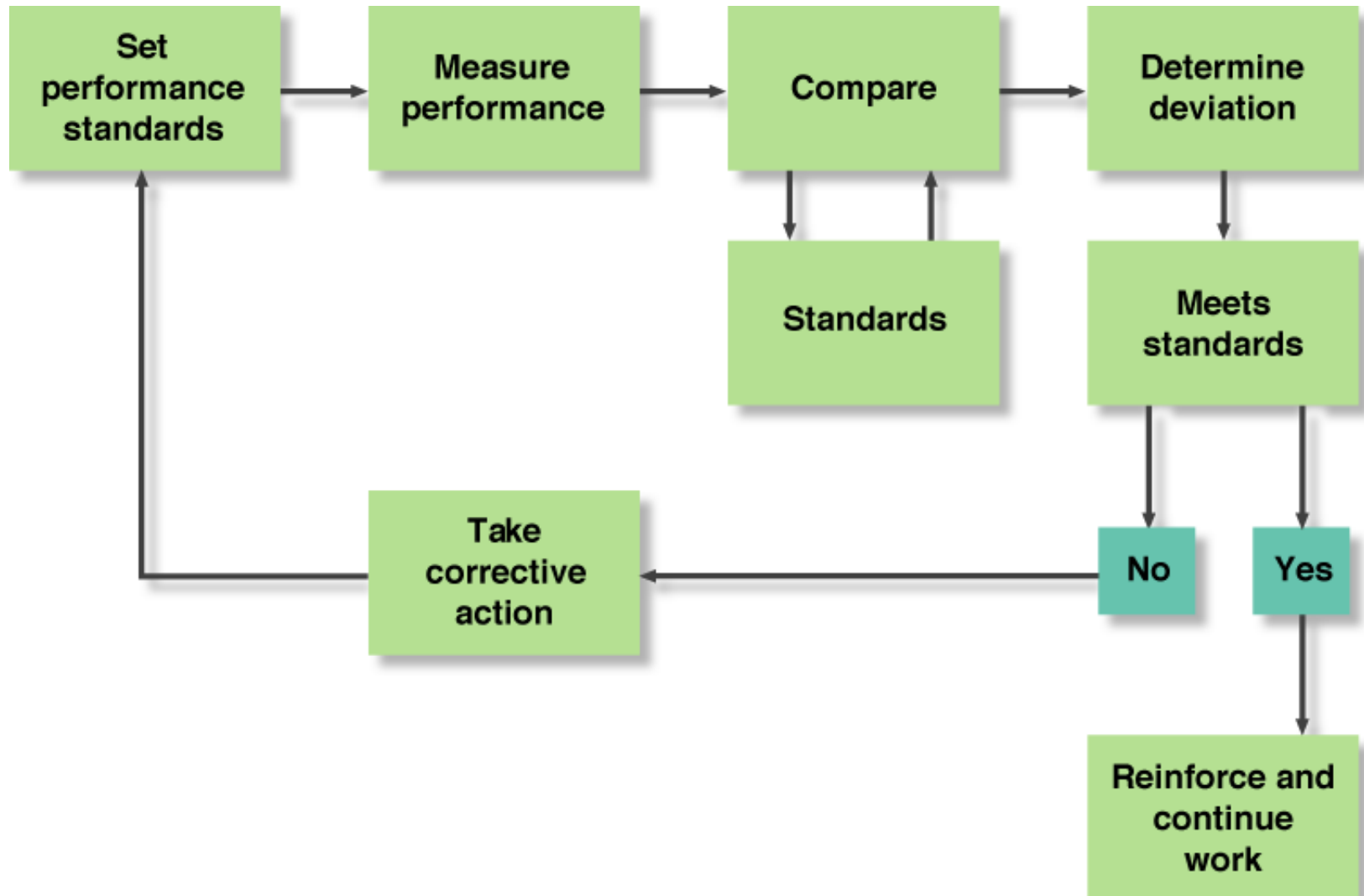
# Project Controlling: The Big Picture ...





# Five Principal Functions of Management

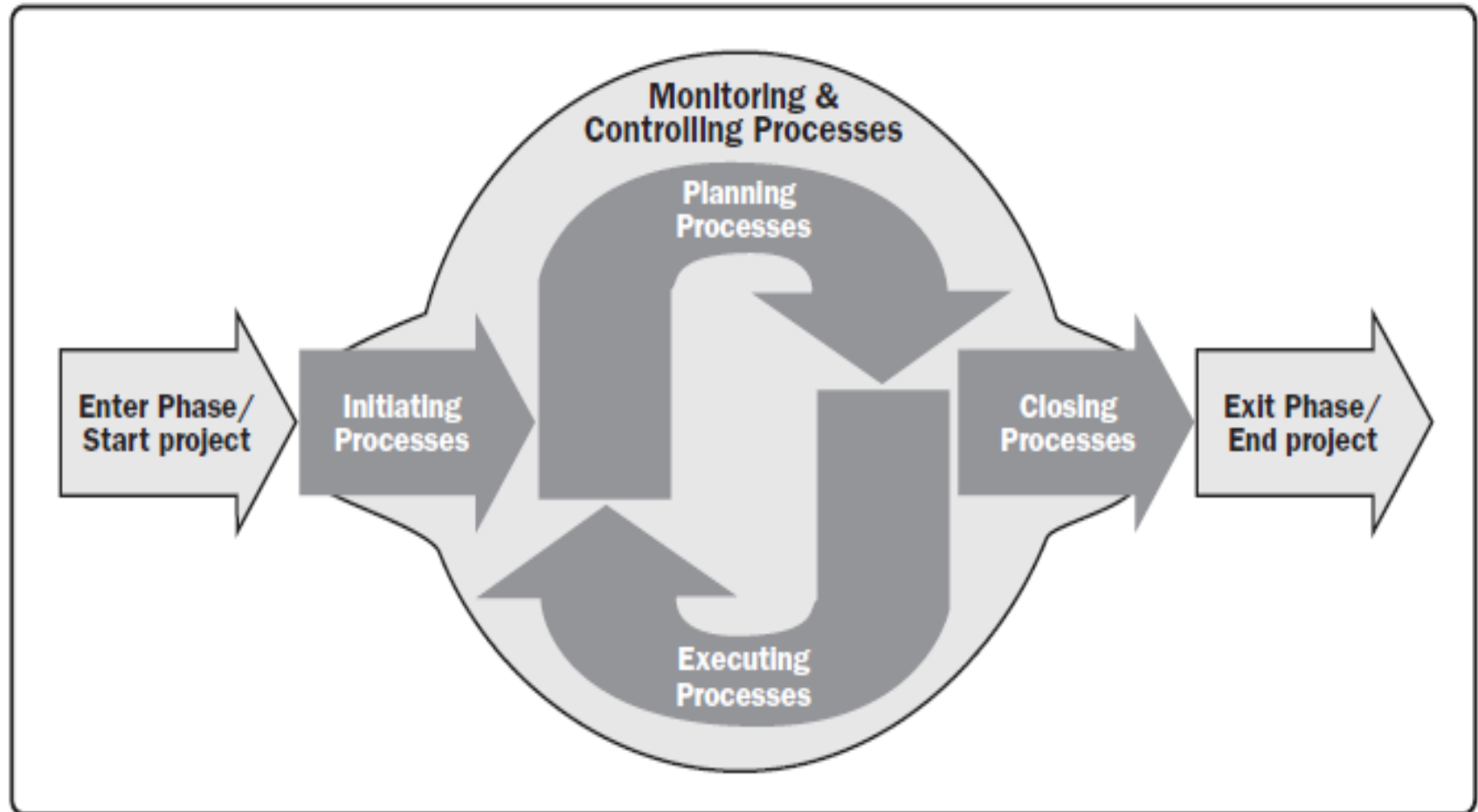
## 5. Controlling



# Five Process Groups of Project Management

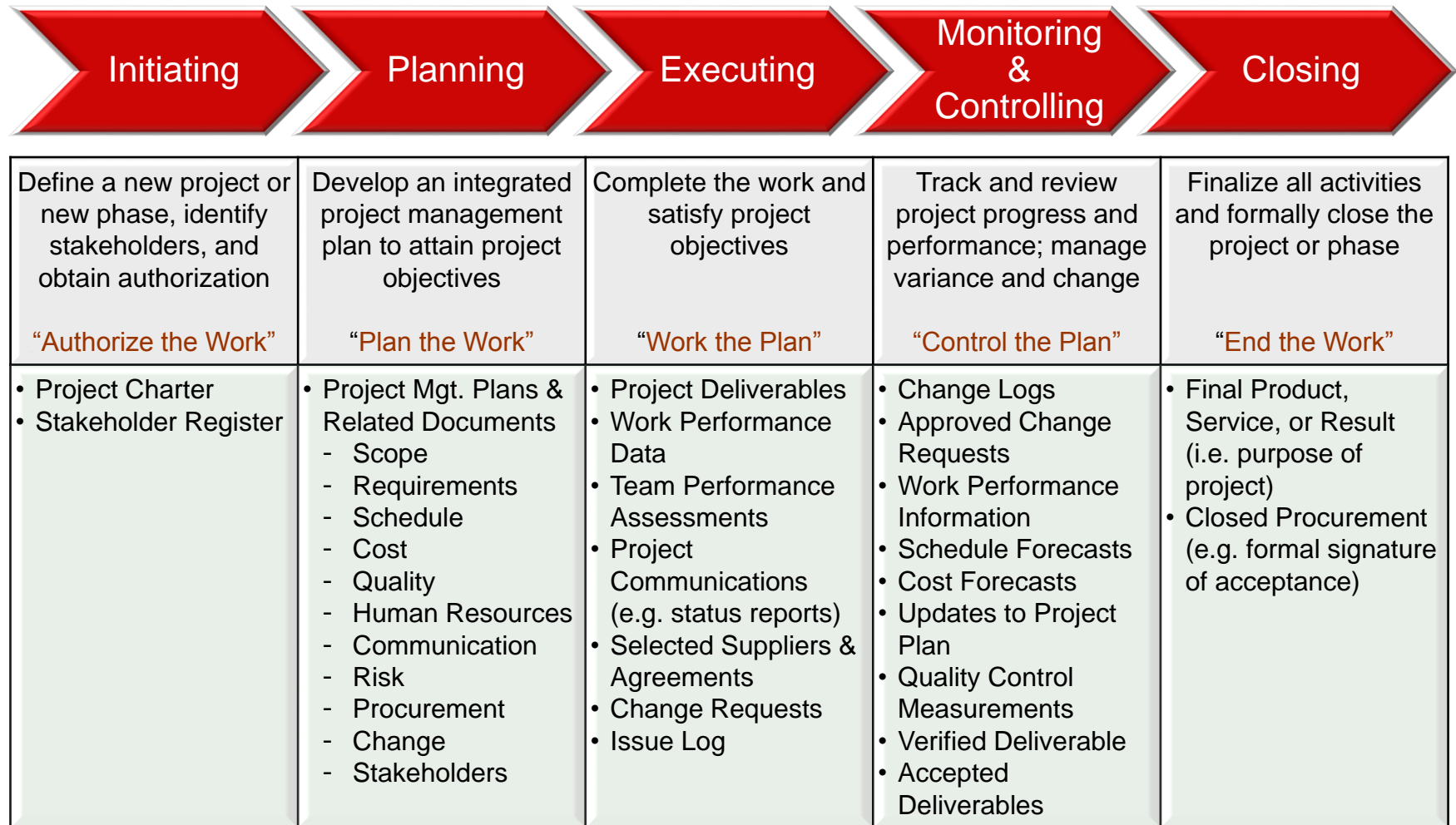


# Five Process Groups of Project Management



# Five Process Groups of Project Management

- A process group is a logical grouping of activities, inputs, tools, techniques, and outputs required for any type of project.






























# Five Process Groups of Project Management

Process Group	Description	Purpose	Output
<b>Initiating</b>	Starting a project	Authorize a project	Project Charter
<b>Planning</b>	Organize and planning	Planning and scheduling the work in the project	Project Plan Management
<b>Executing</b>	Core of project	Performing the project as planned and scheduled in planning process	Project Deliverables (product, service, results)
<b>Monitoring and Controlling</b>	Throughout the project lifecycle	Keep track as the project progresses and identify variance from the plan	Change Requests, preventive and/or corrective actions
<b>Closing</b>	Project closure	Formally closes the project	Product Acceptance, Contract Closure, and Archiving Project Documents

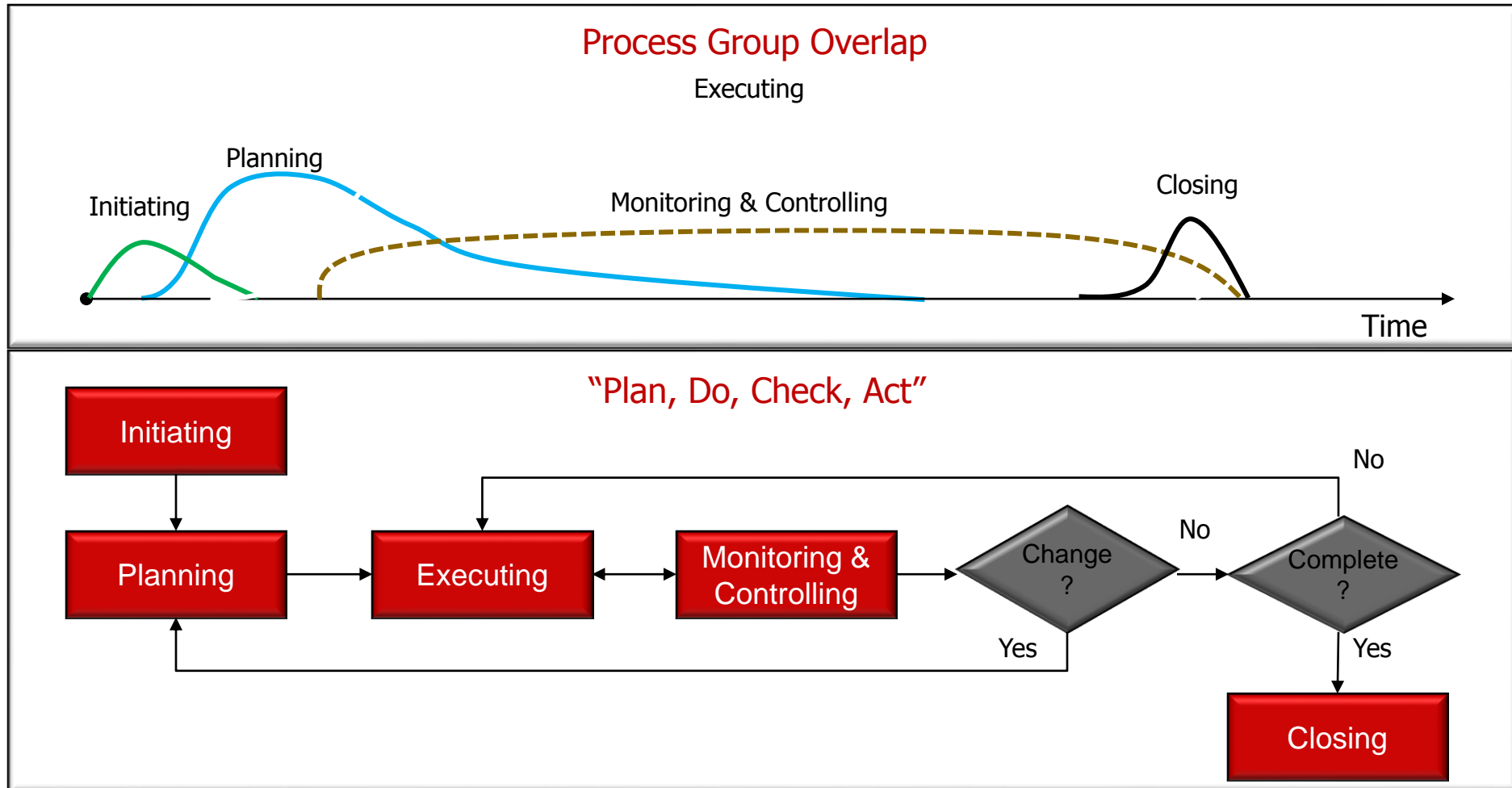
A **Project Charter** is a statement of the scope, objectives and participants in a **project** and is a critical document to ensure that everyone involved in the **project** is aware of its purpose and objectives

# PROJECT MANAGEMENT METHODOLOGY

Pre-Initiation	Initiation	Planning	Executing	Monitoring & Controlling	Closing
 Idea / Initiative	 Project Begins	 PM Plans Actions to Execute Project	 PM Executes Project Management Plan	 PM Tracks, Reviews, and Regulates Project	 PM Finalizes All Activities Across All Process Groups
 Feasibility Study	 Project Manager Assigned	 Project Management Plan	 Project Deliverables: Built, Managed Completed, Tested, Accepted	 Analyze Deliverables (Compare & Verify against Project Plan & Requirements)	 Project Close Out Checklist
 Business Case / High Level Requirements	 Project Charter	 Other Mgmt Plans: Scope Change Time Cost Quality Resource Communication Risk Procurement Requirements Issues Document	 Distribute Meeting Agenda/Minutes Status Reports	 Report Performance Metrics / Project Logs	 Lessons Learned
 Cost Estimates	 Project Governance Established				
 Project Request Form / Project Scaling Worksheet	 Project Stakeholders Identified				 Archive All Project Documents
 Initiative is Evaluated & APPROVED	 Requirements Identified				 Contracts Closed Out
	<u>Gate Go/NoGo</u>	<u>Gate Go/NoGo</u>	<u>Gate Go/NoGo</u>	<u>Gate Go/NoGo</u>	 Team Released

# Applying Project Management Process Groups

- The five process groups overlap and follow a basic cycle of “plan, do, check, act” until project closure.



# Project Life Cycle

The process each manager follows during the life of a project is called the Project Management Life Cycle.

The Project Management Institute (PMI) provides guidance for project management in the Project Management Body of Knowledge (PMBOK). Every project has a life cycle, with a beginning, a life and an end (defined by accomplishing the objective).

## PMBOK Phases/Project Life Cycle

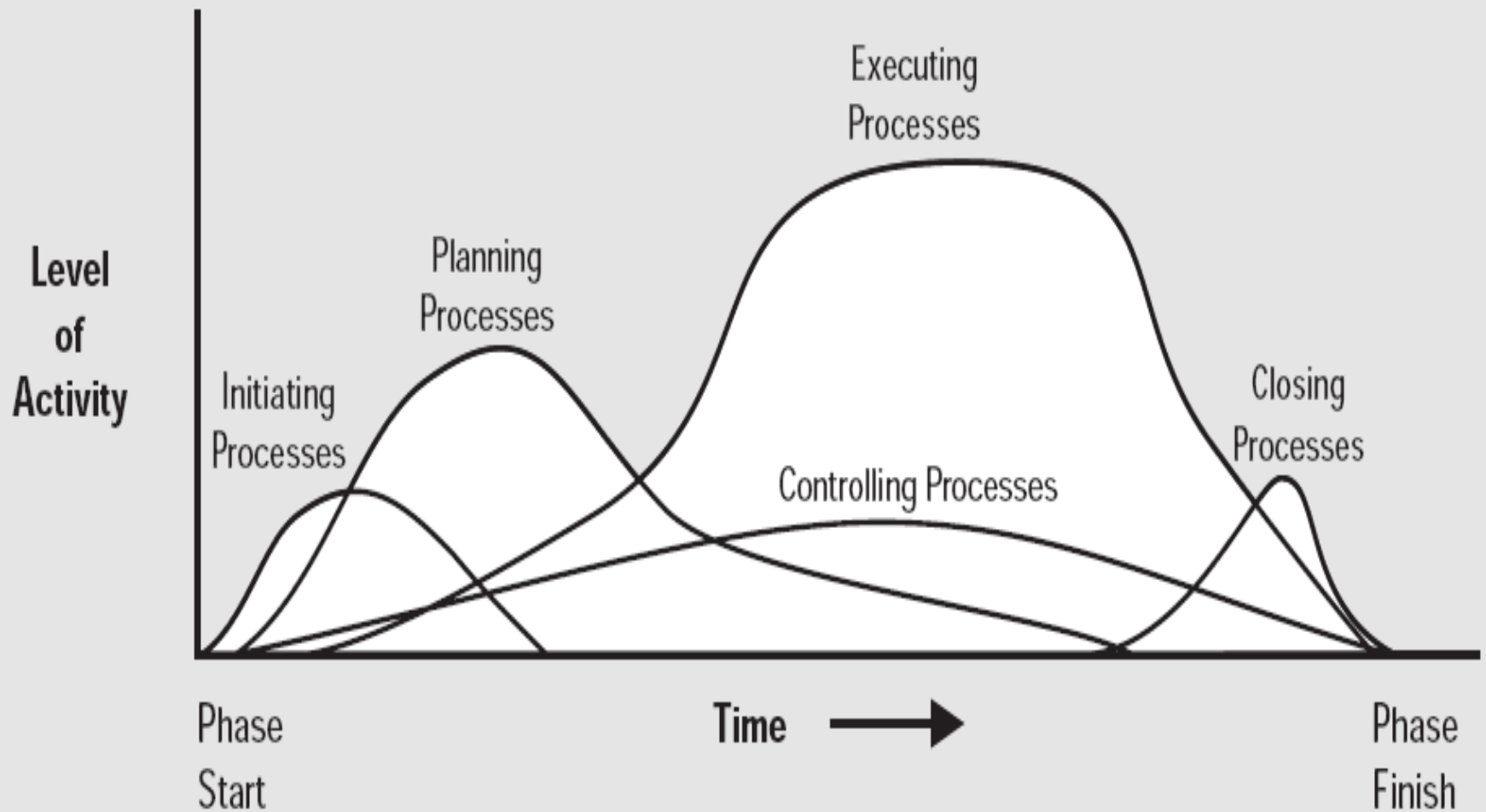
The Project Management Institute identifies four major phases of a project as characteristics of the project life cycle. These four life-cycle phases are initiation, planning, execution, and project closeout.



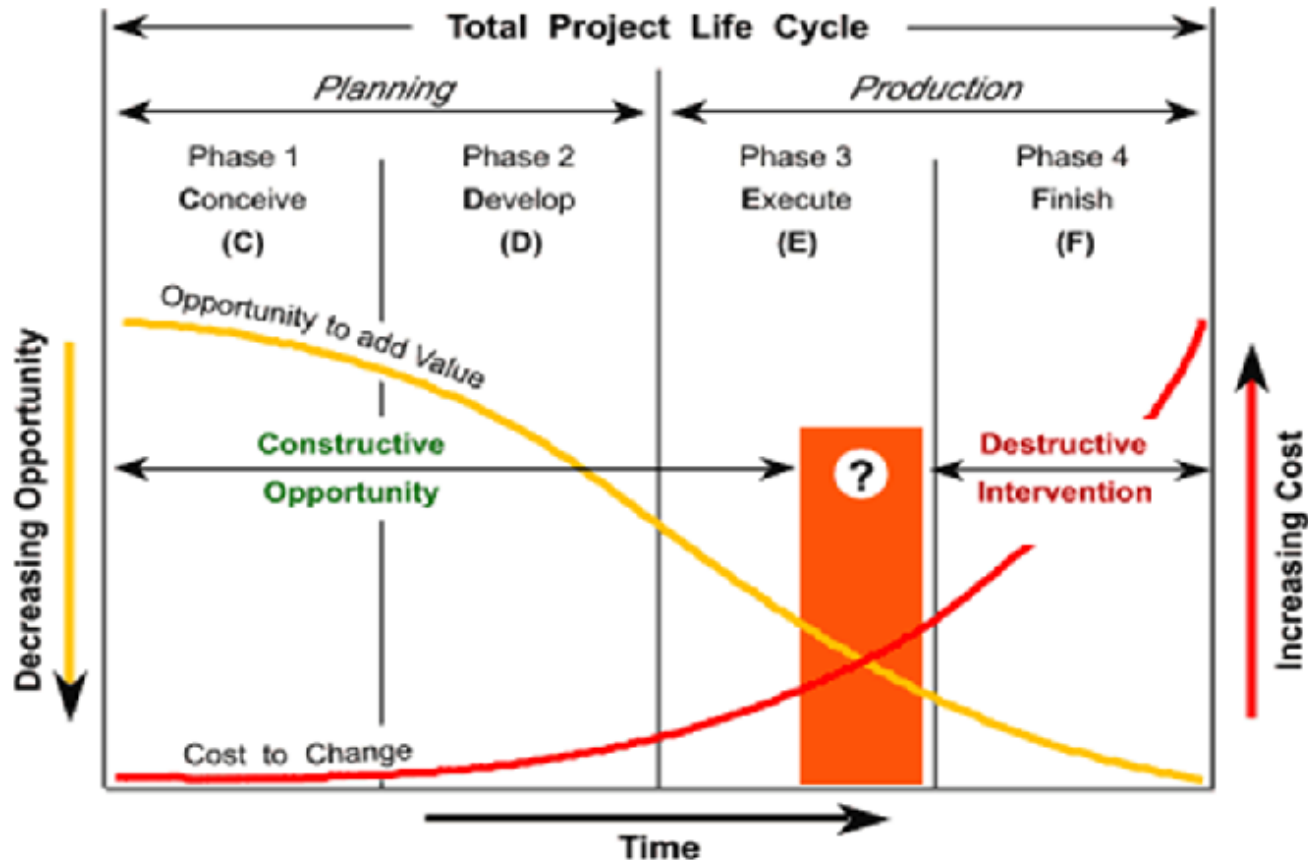


# Project Life Cycle

## Process Group Overlapping Relationship



# Project Life Cycle Variables



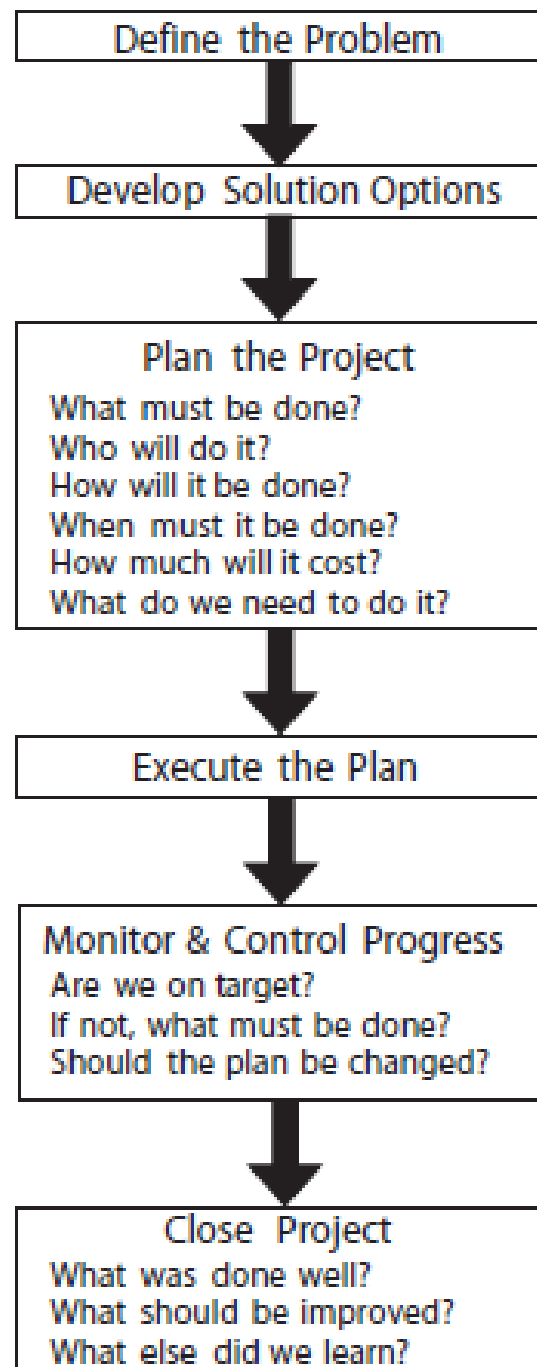
## Potential for Adding Value

The potential for adding value to the products of a project are obviously highest during the conceptual phase of the project and lowest during the finishing phase. Between these two extremes, the curve tends to follow a reverse "S" curve as shown in the figure.

## Escalating Cost to Change or Fix

Conversely, the cost of making changes is lowest in the planning phases, but rises more and more steeply as the project progresses through the two production phases. In construction, for example, it has been suggested that the cost to make a change, or fix a non-conformance, increases by ten times through each succeeding major phase.

## Steps in Managing a Project



# Successful project management

Successful project management can then be defined as having achieved the project objectives:

- **Within Time**
- **Within Cost**
- **At the desired performance/Technology level**
- **While utilizing the assigned resources effectively and efficiently**
- **Accepted by the customer**



## Constraints of the project

- A development project has to manage four basic constraints; scope, schedule, budget and quality.
- The success of a project depends heavily on the ability, skills and knowledge of the project manager to take into consideration these constraints and develop the plans and processes to keep them in balance.

# Constraints of the project

Scope, the boundaries of the project

Schedule, the time to complete the project activities

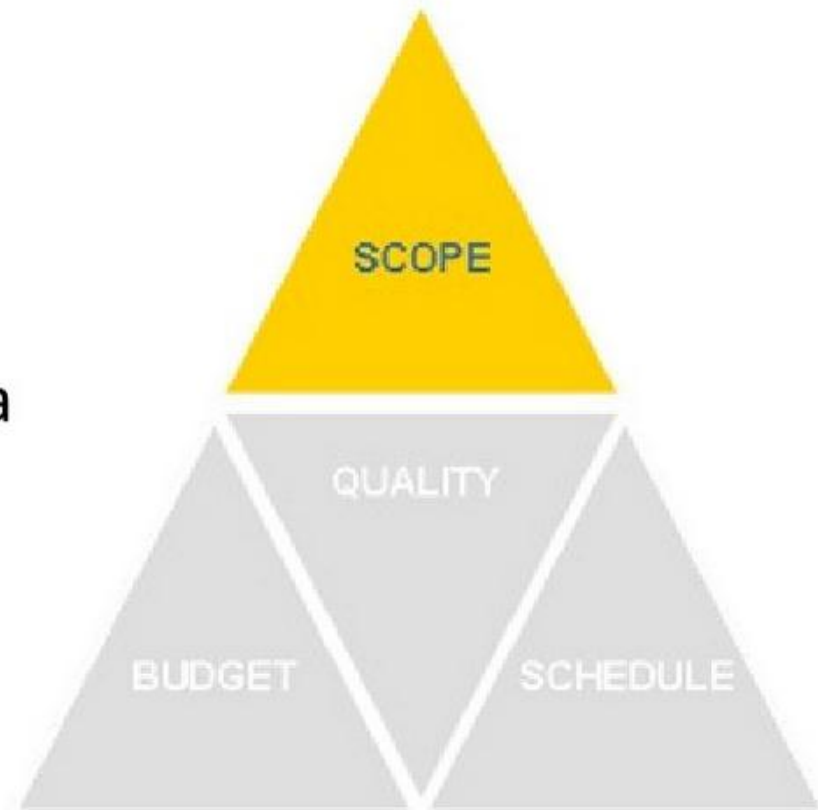
Budget, the funding available to cover all expenses of the project

Quality, achieving the expectations of the stakeholders



# Constraints of the project

**Scope**, is what the project is trying to achieve, it entails all the work involved in delivering the project outcomes and the processes used to produce them. Scope is the boundary of a project, it is what the beneficiaries, and the donors expect from the project.



# Constraints of the project

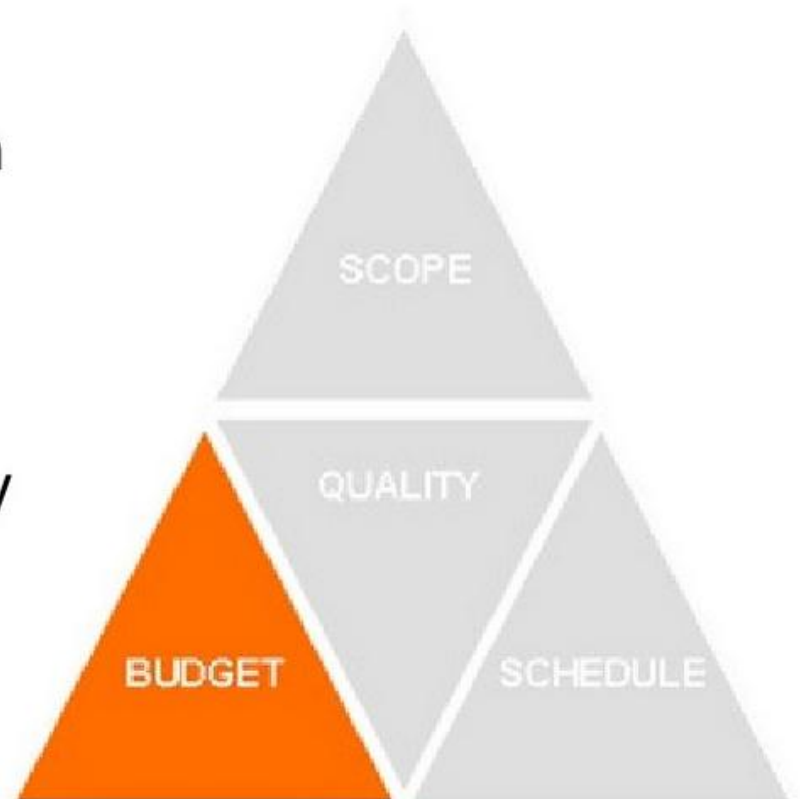
**Schedule**, is defined as the time required to complete the project. It is an approximation of the duration of all activities in the project. Schedule constraints include specific dates to deliver an activity or complete the project.





# Constraints of the project

**Budget**, are the funds approved for the project, they include all the required expenses needed in order to deliver the project within scope and schedule. A number of constraints, financial, political, and organizational, may dictate the methods by which resources such as personnel, equipment, services and materials are acquired.



# Constraints of the project

**Quality**, is the fourth constraint and it is defined as delivering the project outcomes according to the stated or implied needs and expectations of the project beneficiaries and the donor agency. Quality is also defined as the conformance to requirements or fitness for use.



If any one factor changes, at least one other factor is likely to be affected. It is the project manager's duty to **balance** these competing constraints.

# Who should study Project Management?

Anyone who is directly or indirectly involved in; initiating, planning, implementing, monitoring, evaluating and/or controlling a project; in a position which involves a substantive level of decision-making, responsibility, communication and coordination, should be thoroughly familiar with all the subject areas, methodology, processes and tools and techniques of project management.

A good and common project management knowledge platform will increase the likelihood of the project attaining its goal within time and budget.

# Benefits of Project Management

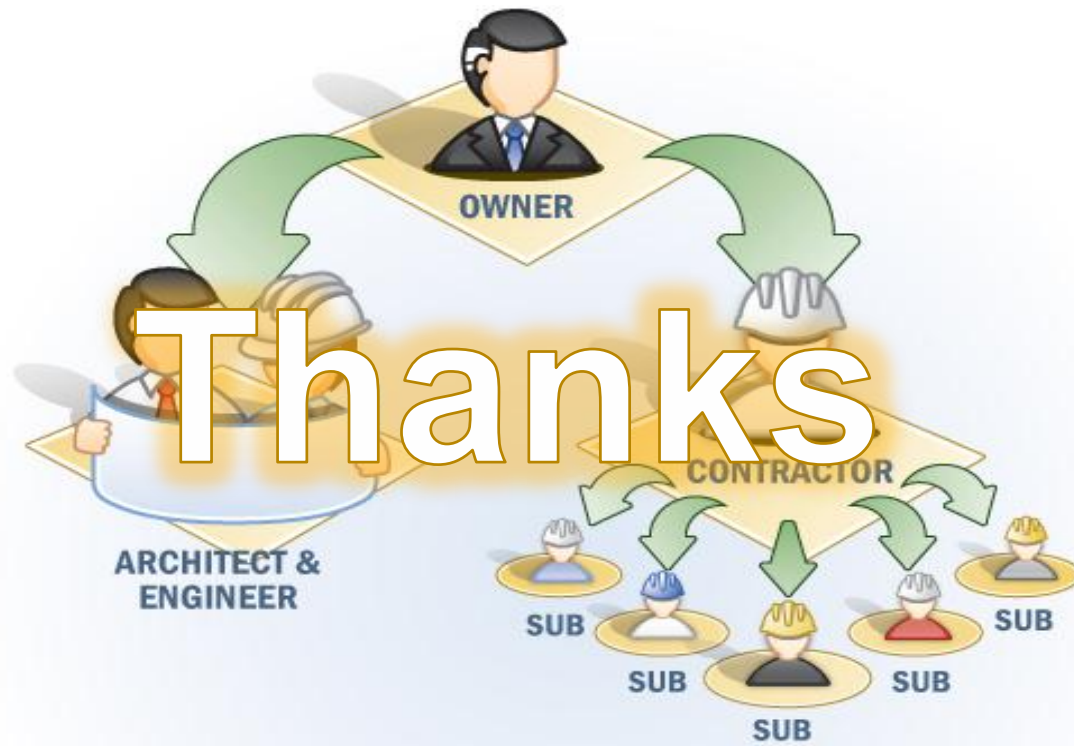
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## Past View

- Project management will require more people and add to the overhead costs.
- Profitability may decrease.
- Project management will increase the amount of scope changes.
- Project management creates organizational instability and increases conflicts.
  
- Project management is really “eye wash” for the customer’s benefit.
- Project management will create problems.
- Only large projects need project management.
- Project management will increase quality problems.
- Project management will create power and authority problems.
- Project management focuses on suboptimization by looking at only the project.
- Project management delivers products to a customer.
- The cost of project management may make us noncompetitive.

## Present View

- Project management allows us to accomplish more work in less time, with fewer people.
  - Profitability will increase.
  - Project management will provide better control of scope changes.
  - Project management makes the organization more efficient and effective through better organizational behavior principles.
  - Project management will allow us to work more closely with our customers.
  - Project management provides a means for solving problems.
  - All projects will benefit from project management.
  - Project management increases quality.
  
  - Project management will reduce power struggles.
  - Project management allows people to make good company decisions.
  
  - Project management delivers solutions.
  
  - Project management will increase our business.
-



Thanks

